# IMMERSE Pre-Training Day 1

May 19, 2023


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# Learning Outcomes

1. Fellows will be able to create a first draft of their equity-focused research goals that can be addressed with mixture modeling in the upcoming year.
2. Fellows will be able to identify how the IMMERSE training goals and opportunities can help them to apply mixture modeling training their research goals

# Overview

- Introductions: IMMERSE Project Team
- Mixture Modeling Family
- Promise of Mixture Modeling
- Underuse of Mixture Modeling in Educational Research
- Goals of IMMERSE training
- Asynchronous Activities

# Introductions: IMMERSE Project Team

Karen

Katherine

Marsha

IMMERSE Project– IES funded Training Grant
(R305B220021)

# Introductions: IMMERSE Project Team

Dina

Honeiah

Casey

IMMERSE Project– IES funded Training Grant (R305B220021)

# ICE BREAKER

https://www.livepolls.app/JW3AQ4

Click to Present

# Android or Apple

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https://www.livepolls.app/3SPW7B

Click to Present

# Dunkin Donuts or Krispy Kreme

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https://www.livepolls.app/3Z4IKH

Click to Present

# Cake or Pie?


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# Housekeeping

- All questions are welcome
  - Feel free to unmute or use chat
- All pre-training sessions will be recorded
- All pre-training materials available here

# What comes to mind when you think about which quantitative methods belong in the mixture modeling family?


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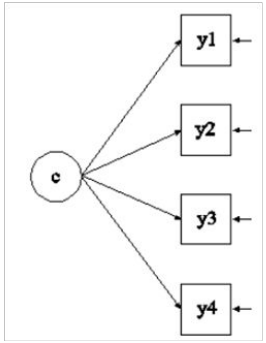
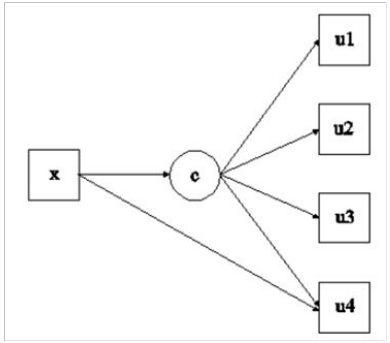
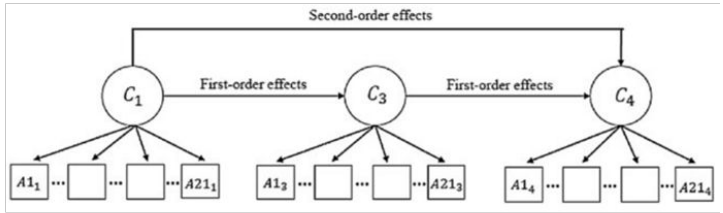
# Mixture Modeling Family

Some members include…

- Cross-sectional:
  - **Latent class analysis (LCA)**
  - **Latent profile analysis (LPA)**
  - Regression mixture models
  - Factor mixture models (FMM)
  - And more….
- Longitudinal:
  - Growth mixture models (GMM)
  - **Latent transition models (LTA)**
  - Survival mixture analysis (SMA)
  - And more…

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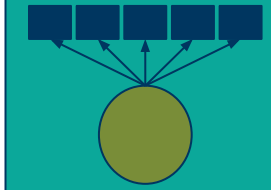
|  | Continuous latent variables (a.k.a., factors) | Categorical latent variables (a.k.a, classes or [finite] mixtures) | Hybrids |
|---|---|---|---|
| Cross-sectional models | Factor analysis<br>Structural equation model (SEM) | Regression Mixture Models<br>Latent Class Analysis<br>Latent Profile Analysis | Factor mixture analysis |
| Longitudinal models | Growth analysis (random effects) | Latent Transition Analysis<br>Latent Class Growth Analysis | Growth mixture analysis |

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# Promise of (Latent Variable) Mixture Modeling

- Free from standard assumption of population homogeneity
- Allows for unobserved population heterogeneity
- Free from antiquated/arbitrary/non-validated grouping/categorizing (typically based on single measures)
- Models that embrace the multidimensional and intersectional
- Person-centered approach (in comparison to variable-centered approaches)

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immerse

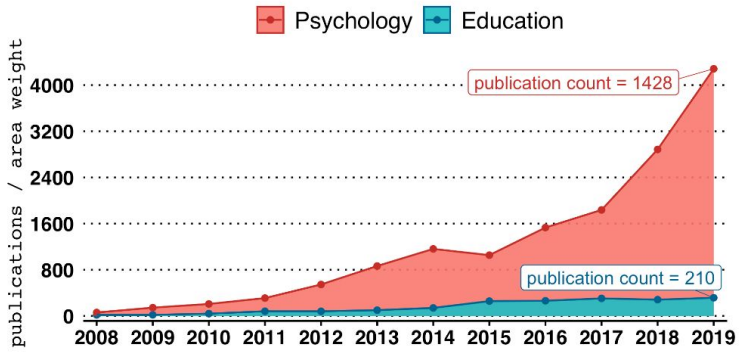
# Institute on Mixture Modeling for Equity-Oriented Researchers, Scholars, & Educators

1st

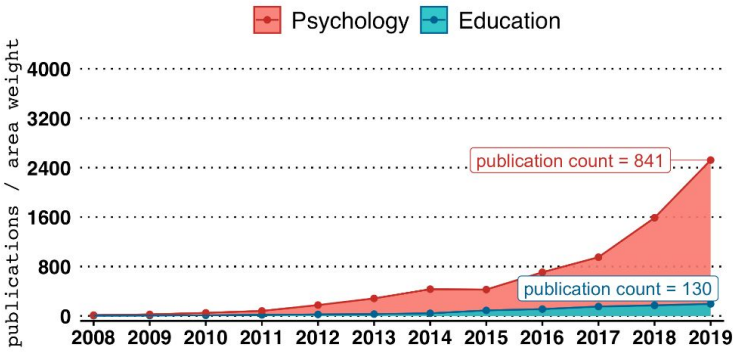
## Class of 2023

How many peer-reviewed research articles have you read using mixture modeling in education?

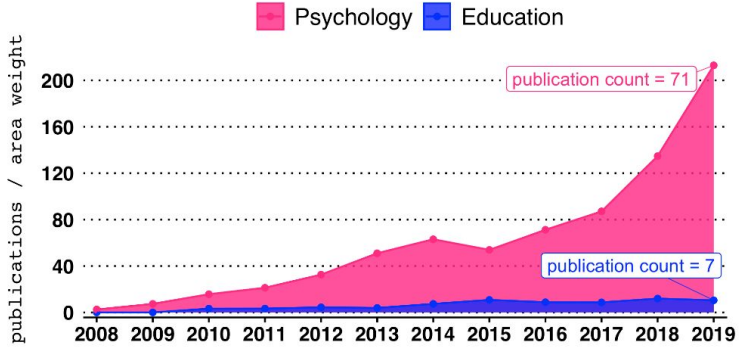
## LCA



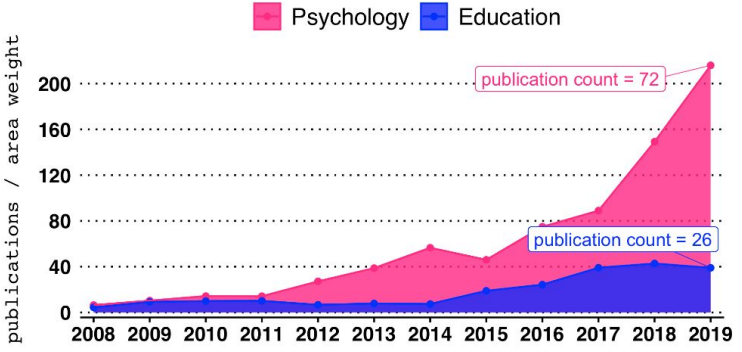

## LPA




## GMM




## LTA



# Barriers to Use

- Relative novelty of the modeling approach
- Lack of understanding about the use of the method
- Few standard course offerings
- Expensive specialized training opportunities
- Need statistical and software knowledge
- Best practices are ever evolving

# Areas for Your Contributions

Breakout Room 1: Jimena, Matt, Monica

Breakout Room 2: Angela C., Melissa, Nneka

Breakout Room 3: Jerica, Jill, Samantha

Breakout Room 4: Angela S., Christa, Zitsi

# What do you notice?

In your breakout rooms (10 minutes), identify research areas that you have in common with others. Add those areas of overlap to the following slides

Write your noticings here

# Goals for Training

Our goal for this training program is support your learning and appropriate use of about mixture modeling approach so that you can conduct rigorous and relevant educational research

- Pretraining
- In-person training
- Ongoing support

Outcomes:

- formative and summative feedback from you about your learning experiences
- your application of mixture modeling to research objectives that you are interested in that by the end of this year that results in a conference presentation, peer reviewed publication, grant proposal, etc.

## Pretraining

Overview of Training and Mixtures

Introduction to Mplus, Mplus Automation

Introduction to Data Science

Data visualization and wrangling

## Mixture Modeling Training

Introduction to Mixture Modeling

Model specification and interpretation

Auxiliary variable inclusion


## Ongoing (through May 2024)

Brown Bags with expert consultants

Opportunities to share your work in progress with other fellows

Contunited Methods training

Ongoing mentoring

Contunited stats/coding support

## Products

Manuscript

Conference submission

Grant application

Other

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# Ongoing Support: Expert Consultants

## Sara Suzuki, Ph.D.

A postdoctoral research fellow at Boston University, has used mixture modeling as a tool to conduct anti-racist research (Suzuki, Morris, & Johnson, 2021).

## Michael Furlong, Ph.D.

Distinguished Professor Emeritus and Research Professor at UCSB, has collaborated on projects using mixture modeling to understand school psychology relevant topics such as bullying, victimization, school belonging, life skills, and mental health.

## Ryan Grimm, Ph.D.

An education researcher at SRI International, uses mixture modeling to understand reading development in multiple groups of students including students at-risk for reading difficulties, children diagnosed with Autism, and English learners.

## Amy Bellmore, Ph.D.

Professor at University of Wisconsin-Madison, has collaborated on projects using mixture modeling to understand peer victimization (Nylund, Bellmore, Nishina, & Graham, 2007) and youth coping strategies (Nylund-Gibson, Garber, Singh, Witkow, Nishina, & Bellmore, 2021).

## Danielle Harlow, Ph.D.

Professor at UCSB, has collaborated on projects using mixture modeling to understand students' understanding of science and engineering (Harlow, Swanson, Nylund-Gibson, & Truxler, 2011).

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Distinguished Professor Emeritus and Research Professor at UCSB, has collaborated on projects using mixture modeling to understand school psychology relevant topics such as bullying, victimization, school belonging, life skills (Quirk et al., 2016), and mental health (Moore et al., 2019).

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# BREAK (5 minutes)

# Thinking about Mixture Modeling

# Typical Research Questions

RQ1: How many latent groups of students learners are there in Kindergarten? Does parent SES and preschool attendance predict who will be in each group?

RQ2: Are there different patterns of student motivation?

RQ3: What do the four classes of teacher attitudes towards technology look like?

# Research Goals

Many applications of mixture modeling is exploratory

- Assume that there are subgroups
- No specific hypothesis about what emergent classes will be or how many there are

Building an argument for the presence of classes

- Previous work discuss differences among students?
- Literature review and find papers with mixtures/clusters?
- Theoretically ground your hypothesis that is it reasonable and meaningful to identify classes.

The argument of the existence of classes is theoretical, not statistical

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# Research Goals

Research goals/objectives:

- Explore what groups exist
  - Note: we don't ask "do classes exist"
- What are the characteristics of latent subgroups?
- What relations are there with the emergent groups
  - Covariates/distal outcomes

# Example Research Goals

- The primary goal of this study was to characterize population heterogeneity in the person-specific stability and change of depression symptomatology spanning across portions of the first two decades of life— from ages 4 through 16.5 years (linked)

- The goals of this study were (1) to examine the diverse ways in which body image concerns and behaviors are manifested in males from middle to late adolescence and (2) to examine how sexual orientation modifies risk for problematic patterns of concerns and behaviors across adolescence (linked)

- Using data from a large nationally representative youth health survey, this paper examines indicators of socioeconomic deprivation and how these indicators vary by demographic characteristics of adolescents. We identify adolescents experiencing household poverty, using latent class analysis, and examine the relationship with a well established measure of neighbourhood deprivation in New Zealand (linked)

# Typical Research Questions

RQ1: How many latent groups of students learners are there in Kindergarten? Does parent SES and preschool attendance predict who will be in each group?

RQ2: Are there different patterns of student motivation?

RQ3: What do the four classes of teacher attitudes towards technology look like?

# Revising RQ1: How many latent groups of students learners are there in Kindergarten? Does parent SES and preschool attendance predict who will be in each group?

In breakout rooms, discuss how you could revise a research question as a research goal (5 minutes). Add your notes to the following slides. Be prepared to share what your group came up with with others.

Breakout Room 1: Jimena, Matt, Monica
Breakout Room 2: Angela C., Melissa, Nneka
Breakout Room 3: Jerica, Jill, Samantha
Breakout Room 4: Angela S., Christa, Zitsi

Write your notes here

# Round 2

Breakout Room 1: Jimena, Melissa, Samantha
Breakout Room 2: Angela C., Jill, Christa
Breakout Room 3: Matt, Nneka, Jerica, Zitsi
Breakout Room 4: Monica, Angela S., Nneka

How many peer-reviewed research articles have you read using mixture modeling in education that focus around issues of equity?

# Diversity, Equity, Inclusion, Justice

- Mixture models can be used to acknowledge differences (Suzuki et al., 2021)
  - Quantitative criticalism, QuantCrit, critical quantitative (Tabron & Thomas, 2023)
- Example: What are some of your concerns when using race as a category?
  - What about the variation within categories of race?
  - Differences among students within categories of race
  - Mixed race individuals are often overlooked

In your research, what are ways you think about differences in populations?

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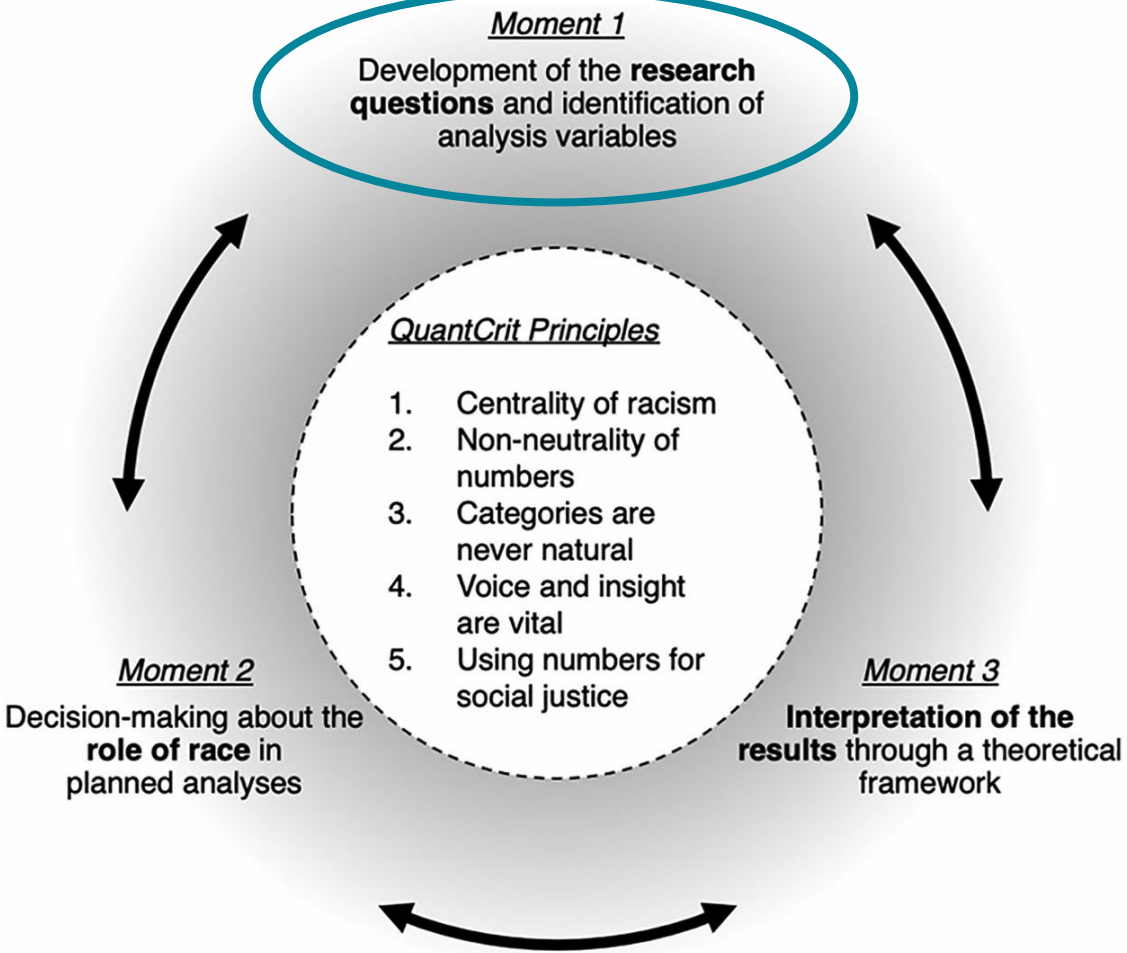
# Research goals that attend to issues of equity (Suzuki et al., 2021, p. 10)

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# Moment 1: Development of the research goals and identification of the analysis variables

Developing research goals that are driven by "a theoretical framework that takes into consideration how structural forces influence disparities in developmental outcomes is essential" (Suzuki et al., 2021, p. 11)

# Revising RQ1: How many latent groups of students learners are there in Kindergarten? Does parent SES and preschool attendance predict who will be in each group?

# Learning Outcomes

1. Fellows will be able to create a first draft of their equity-focused research goals that can be addressed with mixture modeling in the upcoming year.
2. Fellows will be able to identify how the IMMERSE training goals and opportunities can help them to apply mixture modeling training their research questions

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- Goals of IMMERSE training
- Asynchronous Activities

# Asynchronous Activity 1: Thoughts on articles from expert consultants

# Asynchronous Activity 1

- This is an activity you can work on asynchronously.
- Read at least one of the articles from the 5 experts who have used mixture modeling
- Write your thoughts here about something you noticed or something you wondered about how the research addressed issues of equity

# Asynchronous Activity 2: Create a draft of your research goals

# Asynchronous Activity 2

- This is an activity you can work on asynchronously.
- Write your thoughts here on the slide with your name and picture
- Take a first draft at creating research goals that use mixture modeling. This doesn't need to be your *final* research goals but just give it a try!

All pre-training information is housed below. For some pre-training days, there are things to do ahead of time.

https://immerse-ucsb.github.io/pre-training

Your quick, anonymous feedback is appreciated.
Here is a link


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